CLAIMS

What is claimed is:

1. An optical attenuator device selectively operable in a non-actuated state and an actuated state, comprising:

a waveguide for guiding optical energy, the waveguide having an input section coupled to an intermediate section, said intermediate section having reduced confinement of the optical energy relative to said input section;

a thermal source, disposed above said intermediate section, for generating a temperature gradient within a portion of said intermediate section along a vertical axis thereof when said device is in said actuated state, said temperature gradient being sufficient to alter a refractive index profile within said intermediate section such that a portion of said optical energy is deflected downwardly and extracted from said intermediate section.

2. The device of claim 1, wherein said intermediate section of said waveguide comprises a core and a cladding bounding said core, said core and cladding having matched thermo-optic coefficients.

3. The device of claim 2, wherein said core of said intermediate section has at least one transverse dimension that is significantly larger than a corresponding transverse dimension of a core of said input section.

4. The device of claim 3, wherein said intermediate section is coupled to said input section by an adiabatic taper.

5. The device of claim 1, wherein said waveguide further comprises an output section optically coupled to said intermediate section, said output section having increased confinement of the optical energy relative to said intermediate section.

6. The device of claim 2, wherein said core is segmented.

7. The device of claim 2, wherein said core has a refractive index that is less than a refractive index of a core of said input section and greater than or equal to a refractive index of said cladding.

8. The device of claim 7, wherein said refractive index of said core of said intermediate section is equal to said refractive index of said cladding.

9. The device of claim 8, wherein said core of said intermediate section and said cladding are formed from the same material.

10. The device of claim 1, wherein said portion of said optical energy extracted from said intermediate section is adjusted by varying an electrical control signal applied to said thermal source.

11. The device of claim 2, wherein said core and said cladding are formed from polymeric materials.

12. A method for controllably removing optical energy from a waveguide, comprising the steps of:

(a) directing said optical energy from an input section of said waveguide to an intermediate section of said waveguide, said intermediate section having reduced

confinement of said optical energy relative to said input section; and

(b) generating a vertical temperature gradient within said intermediate section sufficient to alter a refractive index profile within said intermediate section such that a portion of said optical energy is deflected downwardly and extracted from said intermediate section.

13. An optical attenuator device selectively operable in an actuated state and a non-actuated state, comprising:

a core;

a lower cladding layer downwardly bounding said core;

a first upper cladding sublayer upwardly and laterally bounding said core, wherein said core, said lower cladding layer and said first upper cladding sublayer have matched thermo-optic coefficients;

a second upper cladding sublayer upwardly adjacent to said first upper cladding sublayer and having a refractive index substantially lower than the refractive index of said first upper cladding sublayer; and

a resistive heater positioned above said core, said resistive heater being configured to generate a thermal gradient within said core, when said attenuator device is in the actuated state, such that the refractive index of a portion of said core is decreased below the refractive index of a portion of said lower cladding layer located downwardly adjacent to said core, causing a portion of the optical energy traveling along said core to be deflected downwardly and extracted from said core.

14. The device of claim 13, further comprising a substrate affixed to said lower cladding layer.

15. The device of claim 14, further comprising an adhesion layer interposed between said substrate and said lower cladding layer.

16. The device of claim 15 wherein said adhesion layer has a refractive index which is less than the refractive index of said substrate and greater than or equal to the refractive index of said lower cladding layer.

17. The device of claim 13, wherein said core, said lower cladding layer, said first upper cladding sublayer, and said second upper cladding sublayer all comprise polymeric materials.

18. The device of claim 13, wherein said portion of said optical energy extracted from core is adjusted by varying an electrical control signal applied to said resistive heater.

19. The device of claim 13, wherein said resistive heater is capable of generating an average vertical thermal gradient within said core of at least 0.53°C/μm.

20. The device of claim 13, wherein said resistive heater is capable of generating an average vertical thermal gradient within said core of at least 0.67°C/μm.

21. The device of claim 13, wherein said resistive heater is positioned no more than 5 μm above an upper boundary of said core.

22. The device of claim 13, wherein the portion of optical energy extracted from said core may be varied in a range between around 0% to around 99.9%.

23. An optical attenuator selectively operable in an actuated and a non-actuated state, comprising:

a core bound by a cladding, said core and said cladding having matched thermo-optic coefficients, said cladding having an upper surface;

a thermal source positioned above said core, said thermal source being configured, when said attenuator is in the actuated state, to generate a thermal gradient within said core such that the refractive index of a portion of said core is decreased below the refractive index of a portion of said cladding located downwardly adjacent to said core, causing a portion of optical energy traveling along said core to be deflected downwardly and extracted from said core; and

a cover plate affixed to said upper surface of said cladding and being held in vertically spaced apart relation with respect to said cladding.

24. The optical attenuator of claim 23, wherein said cover plate is affixed to said cladding by an adhesive applied to areas of said cladding away from said thermal source such that said thermal source is not contacted by either said adhesive or said cover plate.